ForeRunner ES-3810 Ethernet Workgroup Switch Release Notes

Software Version 5.1.x

MANU0334-01
7/31/98

Legal Notices

FORE Systems, Inc. makes no representations or warranties with respect to the contents or use of this manual, and specifically disclaims any express or implied warranties of merchantability or fitness for any particular purpose. Further, FORE Systems, Inc. reserves the right to revise this publication and to make changes to its content, at any time, without obligation to notify any person or entity of such revisions or changes.

RESTRICTED RIGHTS LEGEND

Use, duplication, or disclosure by the government is subject to restrictions as set forth in sub-paragraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013 (October 1988) and FAR 52.227-19 (June 1987).

TRADEMARKS

FORE Systems is a registered trademark of FORE Systems, Inc. *ForeRunner*, *ForeRunnerLE*, *ForeThought*, *ForeView*, *PowerHub*, and *CellPath* are trademarks of FORE Systems, Inc. All other brand or product names are trademarks or registered trademarks of their respective holders.

TABLE OF CONTENTS

1.0 General Description of Software Release Version 5.1.0

These release notes highlight the features that have been added in the *ForeThought* 5.1.0 software release. New features primarily include MPOA support, such as: user interface enhancements for MPOA, LANE 2.0 and MPC functionality to support MPOA; Next Hop Resolution Protocol (NHRP) functions to support MPC; NMM callback functions that initiate platform specific actions when a change or flush occurs to the ingress and egress cache; a Fastpath module for data forwarding over shortcut VCs; and RAALI messages for communicating MPOA specific commands and notifications between the NMM and the uplinks. Also, support for the FSM-8/FX modules has been added.

The FSM-8/FX module itself will not be available until August, 1998. However, in anticipation of this hardware release, support was added to this software release.

2.0 System Requirements

Software version 5.1.0 requires:

- 8 MB of memory on the NMM
- 512K of memory on the ATM uplinks (Rev. C for MM and UTP5; Rev. D for SM)

For information about upgrading memory on FORE Systems devices, contact the FORE Systems' Technical Assistance Center (TAC). (See section 9.0 on page 10.)

3.0 Upgrading to 5.1.0 via TFTP

Refer to Chapter 4 of the *ForeRunner ES-3810 Installation and Maintenance Manual* (MANU0145-04) for TFTP upgrading procedures.

Serial upgrading is not possible with software version 5.1.0; the software image is larger than the maximum image size that can be accommodated in flash. The file **`nmm.ima.z`** is a compressed image that will decompress itself on each reboot. Make sure that you select this file when performing a TFTP upgrade.

4.0 New Features

4.1 Menu Enhancements

The Manage MPOA Menu is reached from the Main Menu of the ES-3810 console interface by selecting the Manage MPOA option. Figure illustrates the Manage MPOA Menu.

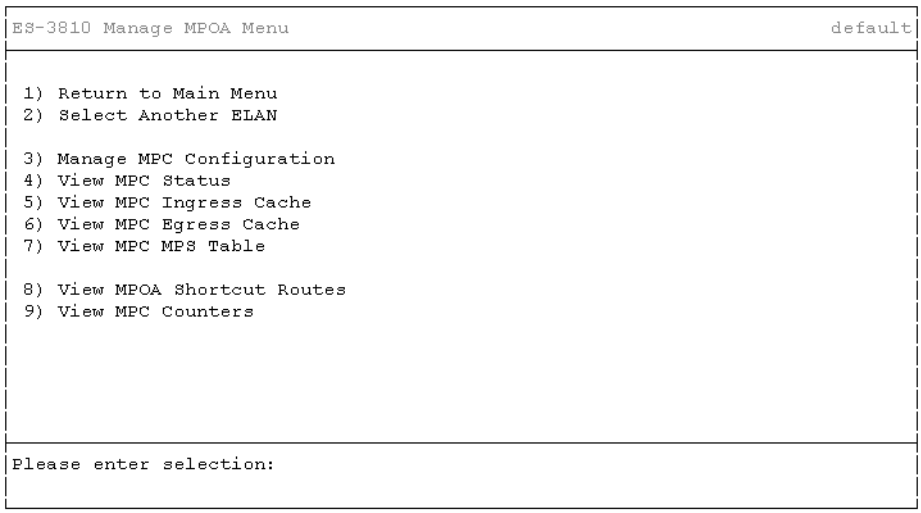

Figure 1 - Manage MPOA Menu

Select Another ELAN	Returns to the ELAN Selection Menu.
Manage MPC Configuration	Displays the Manage MPC Menu.
View MPC Status	Displays the MPC Status view.
View MPC Ingress Cache	Displays the MPC Ingress Cache view.
View MPC Egress Cache	Displays the MPC Egress Cache view.
View MPC MPS Table	Displays the MPC MPS Table view.
View MPOA Shortcut Routes	Displays the MPOA Shortcut Routes view.
View MPC counters	Displays the MPC Counters view.

4.2 Starting MPOA in Release Ver 5.1.0

This section provides a quick guide to getting started using MPOA on the ES-3810. See the *ForeRunner ES-3810 Configuration Manual* (MANU0220-02) for more information pertaining to MPOA management and the user interface enhancements included in this release for MPOA support. For general information about MPOA, see section 6.2 on page 5.

4.2.1 Getting Started

To set up MPOA on the ES-3810, create an ELAN. You will be prompted to set up MPOA for that ELAN; by default MPOA will be enabled on that ELAN in automatic mode. One MPC per ELAN is allowed.

Make sure that TLVs are enabled for the ELAN on which you will be using MPOA.

The ES-3810 will not switch over to manual mode if you forget the ShortCut_Threshold option in LECS.CFG.

At a minimum, you will need the following fields in the LECS.CFG file:

- Match_Ordering
- .ShortCut_Threshold
- .ShortCut_Protocols:IP
- default.Address
- default.Match

For example, the following LECS.CFG file was created for an MPOA test network and two ELANs:

```
Match.Ordering: default, secondary
.ShortCut_Threshold: 10/1
.ShortCut_Protocols: IP
default.Address: 47000580ffe1000000f2da10020480f2da1f0
default.Accept: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
secondary.Address: 47000580ffe1000000f2da10020480f2da1e0
secondary.Accept: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

4.2.2 Manual and Automatic Configuration Modes

To change the state of the MPC from manual to automatic, select Manage MPOA from the Main Menu. Then select Manage Configuration from the Manage MPOA menu. From the Manage MPC Configuration Menu select Config Mode; in the resulting menu you will be prompted to switch states of the MPC from manual to automatic.

When an MPC changes states, it rejoins the ELAN.

If the configuration mode is automatic, all of the MPOA parameters are taken from the LECS. In manual mode, parameters are locally assigned defaults. You can change these in the MPC Configuration Menu.

To change the default MPC from automatic to manual, disable it and then re-enable it in manual mode.

5.0 Known Issues or Concerns

- The View Module option in the Manage Module Menu displays the number of the ATM port incorrectly as 0 and the memory size incorrectly as 128K. Also, the serial number and hardware version of the second ATM module are incorrect.
- While configuring the LEC in automatic mode, the old well-known address for the LECS will be displayed. Once the configuration is done, if the LECS is running on the device running LANEv2, the new well-known address will be displayed when the LEC configuration is viewed.
- The ES-3810 allows a LEC to join a LES with a different name.
- If there are two ATM modules installed in the system and the ES-3810 is searching for information on a module that is not connected, the MPC status reported might be "Waiting for Configuration." If this is the case, cache information, etc., cannot be viewed. As a workaround, select the View MPC Status option and use Switch to select the MPC on the other uplink that has a status of "In Service." From there select Quit to return to the Manage MPOA Menu.
- The etherHistoryPkts is not updated when bad packets are received.
- The etherStatsCRCAlignErrors does not get updated when packets with CRC errors are received.
- The etherHistoryOversizePkts is updated when oversize packets with errors are sent.
- The etherHistoryUndersizePkts is updated when undersized packets with alignment errors are sent.
- The etherStatsFragments and etherHistoryFragments are updated when undersized packets with no errors are received.

6.0 Special Information

This section presents special information for the ES-3810, including both detailed information on the manufacturing mode menu and how to reset parameters to return to the normal operating mode as well as general information on multiple protocols over ATM (MPOA).

6.1 Manufacturing Mode: Erase Configuration and Reboot Option

Selecting the Manage System option from the Main Menu will take you to the Manage System Menu. In this menu, if you select the Erase Configuration and Reboot option, the ES-3810 will reboot into manufacturing mode and a different main menu will be displayed. (This menu is used for manufacturing purposes.) To return to the normal operating menu, change the Flex boot parameters as follows:

1. From the manufacturing mode main menu, select option **8**.
   - At the `Enable auto-execute` prompt, type `y`.
   - At the `Enable POST` prompt, type `y`.
   - At the `Enable manufacturing test mode` prompt, type `n`.
   - At the `Auto break` prompt, type either `y` or `n`.
   - At the `Are you satisfied with these settings` ? prompt, type `y`.
2. From the manufacturing mode main menu, select option **10**. This will reboot the box and return the ES-3810 to the normal operating menu.

6.2 MPOA Overview

For more information about configuring and managing MPOA on the ES-3810, see Chapter 9, "Managing MPOA," in the *ForeRunner ES-3810 Configuration Manual* (MANU0220-02).

6.2.1 About MPOA

MPOA integrates LAN Emulation (LANE) and Next Hop Resolution Protocol (NHRP) to preserve the benefits of LANE, while allowing inter-subnet, internetwork layer protocol communication over ATM VCCs without requiring routers in the data path. MPOA provides a framework for effectively synthesizing bridging and routing with ATM in a diverse environment, providing a unified paradigm for overlaying internetwork layer protocols on ATM. Using both routing and bridging information, MPOA is capable of locating the optimal exit from the ATM cloud.

By employing virtual routing— the physical separation of internetwork layer route calculation and forwarding— MPOA provides a number of key benefits:

- Efficient inter-subnet communication;
- Increased manageability through the reduction of the number of devices that must be configured to perform internetwork layer route calculation;
- Increased scalability through the reduction of the number of devices participating in internetwork layer route calculations.

Through the use of virtual routing, MPOA reduces the complexity of edge devices, such as the ES-3810, by eliminating the need for these devices to perform internetwork layer route calculations.

The primary goal of MPOA is the efficient transfer of unicast data. To accomplish speed and efficiency of data transfer, MPOA utilizes the strengths of ATM network topology and configuration to effectively link up shortcuts between a source and destination. MPOA components establish shortcut VCCs between each other as necessary to transfer data and control messages over an ATM network.

6.2.2 MPOA Shortcuts

A shortcut is a direct one-hop path to a destination or to the nearest transit point to a destination. For a shortcut to be established: an ingress (destined toward the ATM cloud) MPC must first have been configured on the originating device; all routers connecting the originating device to the terminating device must have been configured with MPSes; and the terminating device must a have an MPC or MPS configured.

Default forwarding for the MPOA System occurs via routers. When an MPC becomes aware of a particular traffic flow that could benefit from a shortcut, the ingress MPC needs to determine the ATM address associated with the egress device (outside of the ATM cloud). To obtain the ATM address for a shortcut, the ingress MPC sends an MPOA Resolution Request to the appropriate ingress MPS. When this MPS is able to resolve the resolution request, a reply is returned to the ingress MPC that contains an ATM address of the egress device.

If a shortcut is established, the ingress MPC strips the DLL encapsulation from the packet and sends it via the shortcut. When the packet arrives via shortcut at the egress MPC, it is examined and either a matching egress cache entry is found or the packet is dropped. All encapsulated information is stored at the egress MPC / MPS and is inserted at the egress point before being passed on to legacy ports.

6.2.3 MPOA Components

MPOA is designed with a client/server architecture. There are two types of MPOA logical components: MPOA Clients (MPC) and MPOA Server(s) (MPS). An MPC can service one or more LECs and communicates with one or more MPSes. An MPS converts between MPOA requests and replies and NHRP requests and replies on behalf of the MPCs.

In its ingress role, an MPC detects flows of packets that are being forwarded over an ELAN to a router that contains an MPS. When it recognizes a flow that could benefit from a shortcut that bypasses the routed path, it uses an NHRP-based query-response protocol to request the information required to establish a shortcut to the destination. If a shortcut is available, the MPC caches the information in its egress cache, sets up a shortcut VCC, and forwards frames for the destination over the shortcut.

In its egress role the MPC receives internetwork data frames from other MPCs to be forwarded to its local interfaces/users. For frames received over a shortcut, the MPC adds the appropriate DLL encapsulation and forwards them to the higher layers (e.g., a bridge port or an internal host stack). The DLL encapsulation information is provided to the MPC by an egress MPS and stored in the MPC's egress cache.

An MPS is the logical component of a router that provides internetwork layer forwarding information to MPCs. A full NHS, as defined in NHRP, is included in the MPS. The MPS interacts with the local NHS to answer MPOA queries from ingress MPCs and provide encapsulation information to egress MPCs.

6.2.4 MPOA Information Flows

The MPOA solution involves a number of information flows that can be categorized as MPOA control flows and MPOA data flows. By default, all control and data flows are carried over ATM VCCs using LLC/SNAP (RFC 1483) encapsulation. Configuration flows use the formats described in LANE; MPSs and MPCs communicate with the LAN Emulation Configuration Server (LECS) to retrieve configuration information.

MPC-MPS control flows are used for MPC cache management. The MPOA Resolution Request/Reply allows the ingress MPC to obtain shortcut information. The ingress MPS may trigger the ingress MPC to make a request by sending the MPOA Trigger Message. The MPOA Cache Imposition Request/Reply allows the egress MPS to give the egress MPC egress cache information. Finally, either the egress MPC or an MPS may send a Purge message if it discovers that cached information has become invalid.

MPS-MPS control flows are handled by standard internetwork layer routing protocols and NHRP. MPOA does not define any new MPS-MPS protocols. MPOA requires no new replication techniques and relies upon the standard techniques provided by LANE and internetwork layer routing protocols.

MPC-MPC control flows are used to invalidate erroneous cache information. An egress MPC may send a data plane purge to an ingress MPC if it receives misdirected packets from that MPC. This causes the MPC to invalidate its erroneous cache information.

MPC-MPC data flows are used primarily for the transfer of data between MPCs over MPOA shortcut VCCs.

MPC-NHC data flows are used to allow an MPC to send unicast data to an NHC and to allow an NHC to send unicast data to an MPC.

6.2.5 MPOA Operations

MPOA performs the following operations: configuration, discovery, target resolution, connection management, and data transfer. These operations are described in the following subsections.

6.2.5.1 Configuration

MPCs and MPSes require configuration. By default, MPOA components retrieve their configuration parameters from the LECs.

MPOA components must be able to configure via the LECs.

6.2.5.2 Discovery

To reduce operational complexity, MPOA components automatically discover each other (i.e., the MPC's and MPSs "learn" of each other's existence) using extensions to the LANE LE_ARP protocol that carry the MPOA device type (MPC or MPS) and ATM address. This information is discovered dynamically and used as needed.

MPCs are not NHCs and do not register host internetwork layer addresses with NHSes using NHRP Registration.

6.2.5.3 Target Resolution

MPOA target resolution uses an extended NHRP Resolution Request protocol to allow MPCs to determine the ATM address for the end points of a shortcut. The protocol is interpreted from different perspectives by the ingress MPC, the ingress MPS, the egress MPS and the egress MPC.

An ingress MPC learns the MAC addresses of MPSes attached to its ELAN from the device type TLVs in LE_ARP responses. The MPC is required to perform flow detection, based on internetwork layer destination addresses, on packets destined for these learned MAC addresses. Additionally, an MPC is permitted to perform other types of flow detection.

The ingress MPS processes MPOA Resolution Requests sent by local MPCs. The ingress MPS can answer the request if the destination is local; otherwise, it re-originates the request along the routed path through its local NHS. To insure that the reply is returned to the originating MPS, the ingress MPS uses its internetwork layer address as the source protocol address in the re-originated request. All other fields from the MPOA resolution request are copied, in particular the MPC's data ATM address, which is used as the NBMA address, and all TLVs.

A new Request ID is set by the ingress MPS for the re-originated request so that downstream NHSes do not cache the association of the resulting internetwork layer and ATM addresses. On receiving a reply, the ingress MPS restores the Request ID field and source protocol address and returns an MPOA Resolution Reply to the ingress MPC.

The egress MPS sources an MPOA Cache Imposition Request when an NHRP Resolution Request targeted for a local MPC arrives at the egress MPS serving that MPC. After receiving the MPOA Cache Imposition Reply from the egress MPC, the egress MPS sends an NHRP Resolution Reply toward the request originator. Additional information requested by the ingress MPC (and included in the MPOA Cache Imposition Request and the MPOA Cache Imposition Reply messages) must be included in the NHRP resolution as well.

The egress MPC must send an MPOA cache Imposition Reply for every MPOA Cache Imposition Request. To formulate its reply, the MPC must determine if it has the resources to maintain the cache entry and potentially receive a new VCC. If the MPC cannot accept either the cache entry or the VCC that might result from a positive reply, it sets the appropriate error status and returns the MPOA Cache Imposition Reply to the MPS. If the MPC can accept this cache entry, it inserts an ATM address and may modify the MPOA Egress Cache Tag Extension (if present) to be used by the ingress MPC in connection with this shortcut, sets a success status, and sends the MPOA Cache Imposition Reply to the egress MPS.

In some configurations, it is possible for an egress MPC to receive conflicting next-hop forwarding instructions for the same source ATM address and internetwork layer address pair. If this conflict occurs, the egress MPC will take one of the following actions to ensure that packets are forwarded properly: an appropriate tag in the MPOA cache Imposition Reply may be included; a distinct destination ATM address may be included in the MPOA Cache Imposition Reply; or, the imposition request may be refused.

6.2.5.4 Connection Management

MPOA components establish VCCs between each other as necessary to transfer data and control messages over an ATM network. For the purpose of establishing control VCCs, MPOA components learn of each other's existence through the discovery process described above. For the purpose of establishing data VCCs, MPOA components learn of each other's existence through the resolution process described above.

6.2.5.5 Data Transfer

The primary goal of MPOA is the efficient transfer of unicast data. Unicast data flow through the MPOA system has two primary modes of operation: the default flow and the shortcut flow. The default flow follows the routed path over the ATM network. In the default case, the ES-3810 acts as a Layer 2 bridge. Shortcuts are established by using the MPOA target resolution and cache management mechanism.

When an MPC has an internetwork protocol packet to send for which it has a shortcut, the ES-3810 acts as an internetwork level forwarder and sends the packet over the shortcut.

7.0 The FORE Website

For the latest technical documentation and release notes for the ES-3810 and other FORE products, visit the FORE technical manual website at:

`http://www.fore.com/products/manuals.htm`

The website provides manuals in Portable Document Format (PDF). They can be viewed or printed using Adobe Acrobat Version 3.0 Readers.

Adobe Acrobat is unavailable on Windows NT running on DEC Alpha. To access the User Manual, print the PostScript version in the `\DOCS` directory or view it using a PostScript viewer.

Acrobat is unavailable in NetWare. You must run Acrobat from a Windows-based machine.

7.1 Viewing the On-line Manual

The on-line manual, contained on the FORE documentation CD included with the switch, contains further information about the ES-3810. The on-line manual is provided in Portable Document Format (PDF) and can be viewed or printed using the Acrobat Reader Version 3.0 included on the FORE documentation CD.

If you already have the Acrobat Reader installed on your machine, you can simply run Acrobat and open the PDF file on the documentation CD. Otherwise, you can install Acrobat using the files and directions.

8.0 Year 2000 Capable

A FORE product, when used in accordance with its associated documentation, is Year 2000 Capable when, upon installation, it accurately stores, displays, processes, provides and/or receives date data from, into, and between the twentieth and twenty-first centuries, including leap year calculations, provided that all other technology used in combination with said product properly exchanges date data with it.

9.0 Obtaining Technical Assistance

In the U.S.A., you can contact FORE Systems' Technical Assistance Center (TAC) using any of the following methods:

1. You can receive online support via TACtics Online at:

   http://www.fore.com/tac

2. You can contact TAC via e-mail at:

   support@fore.com

3. You can telephone your questions to TAC at:

   1-800-671-FORE (3673) or **+1 724-742-6999**

4. You can FAX your questions to TAC at:

   +1 724-742-7900

Technical support for non-U.S.A. customers should be handled through your local distributor.

No matter which method is used to reach the TAC, customers should be ready to provide the following:

- A support contract ID number
- The serial number of each product in question
- All relevant information describing the problem or question